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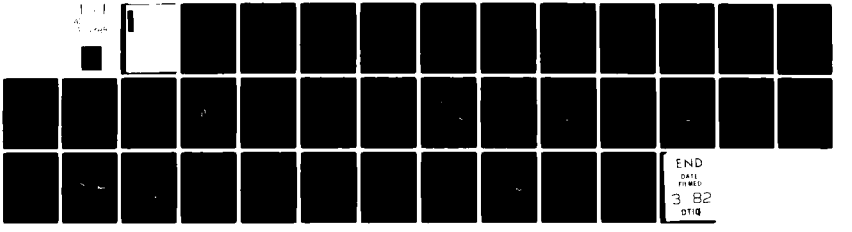

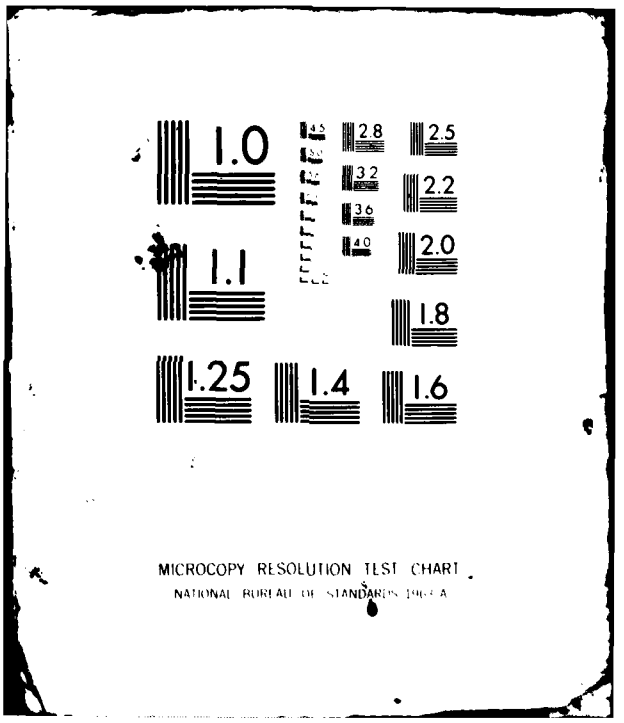
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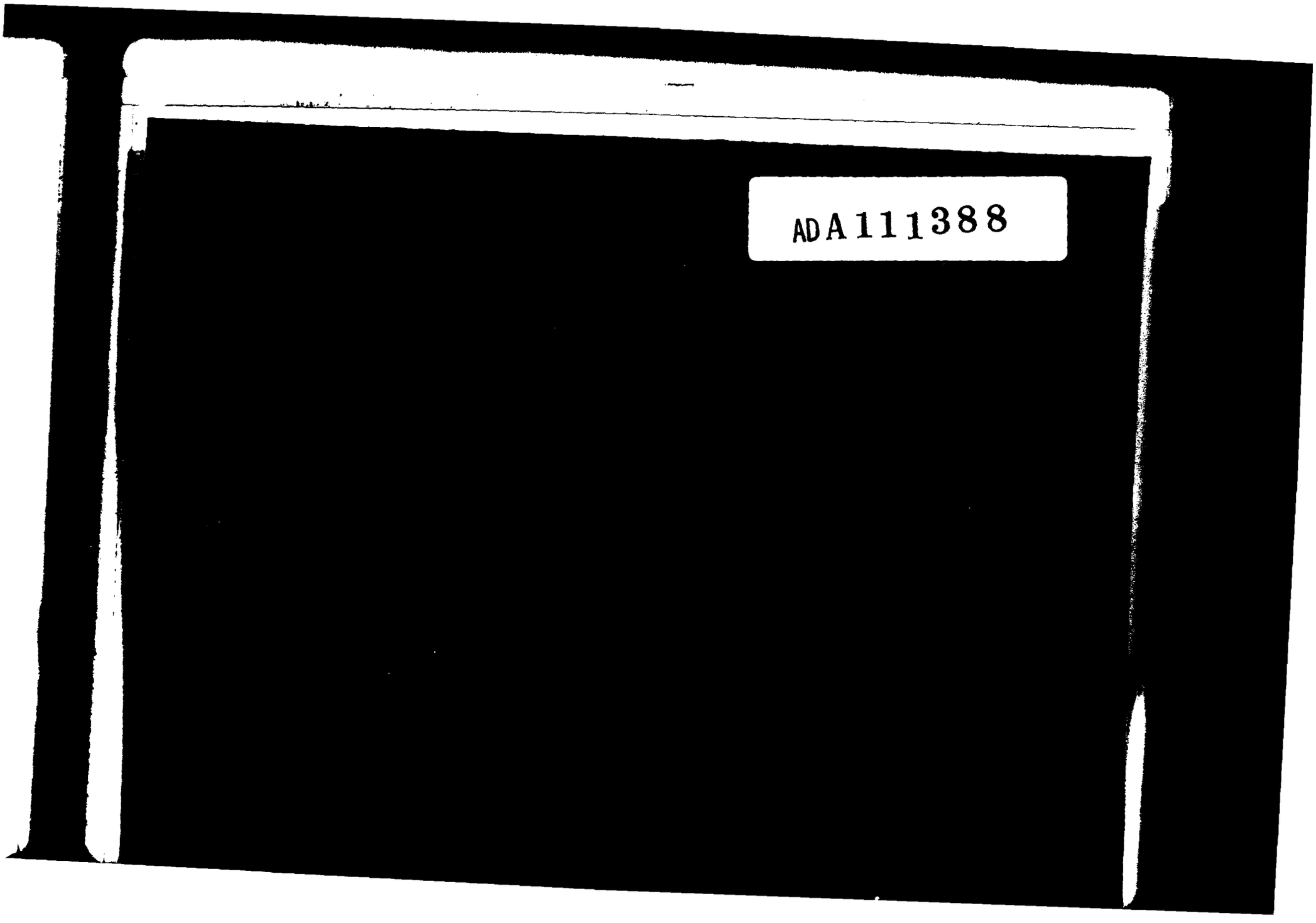
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1. Digital data display; geophysical data
2. Geographical data processing
3. East coast margin of the United States

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By

Carl Bowin, Julie Milligan
and
Karen Dunkle

WOODS HOLE OCEANOGRAPHIC INSTITUTION
Woods Hole, Massachusetts 02543

December 1981

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John I. Ewing, Chairman
Department of Geology and Geophysics

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ABSTRACT

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INTRODUCTION

This atlas comprises maps for the East Coast margin of the United States of free-air gravity anomaly, geoid anomaly, regional geoid anomaly, residual geoid anomaly, magnetic crustal anomaly, and bathymetry. Maps of estimated error are included for free-air gravity and magnetic crustal anomaly. Estimated error maps for the geoid data are not included because for the marine areas, these data are uniformly of very low error. The data are presented in three sets of maps of northern, central, and southern portions of the margin.

METHODOLOGY

Data for all these maps were prepared by interpolating values to an orthogonal grid of latitude and longitude positions. This grid is such that all points are equally spaced in a Mercator projection. For a given area, the more dense the number of grid points, the greater can be the detail recorded in the final maps. However, the denser the grid, the more computer time required for the interpolation. The maps of this atlas are a compromise, having a spacing of 0.2^{o} in longitude. This is equivalent to approximately 25 grid points per degree square.

The interpolation for the gravity, geoid, and magnetic crustal anomaly was accomplished using objective mapping techniques (Bretherton, et. al., 1976; Gandin, 1965) which provided optimal estimates in the sense of a Gausso-Markov least square estimator. The technique also provides

relative error estimates: the higher the error estimate, the poorer the quality of the interpolated value. Note that higher error estimates usually occur when the data distribution for interpolation is the weakest.

The gravity data was interpolated from our digital gravity data library at Woods Hole Oceanographic Institution. This library comprises over four million observations world-wide. The geoid data was interpolated from our digital library of GEOS-3 radar altimeter measurements as adjusted by the Defense Mapping Agency (Brace, 1977). This data base covers all the world's oceans between latitudes of about 65^{o}N and 65^{o}S. The magnetic crustal anomaly values were interpolated from a set of global estimates at a 2^{o} latitude and longitude spacing from MAGSAT data prepared by Robert Langel of Goddard Space Flight Center (P.C. August, 1981).

The interpolation of bathymetry data was accomplished using the U.S. Navy SYNBAPS system installed on our VAX computer. This system was developed by Roger van Wickenhouse of NORDA and comprises gridded polynomial coefficients from which bathymetry can be calculated (Van Wyckhouse, 1973). Error estimates are not provided.

The regional geoid anomaly was computed from the GEM-9 set of spherical harmonic coefficients (Lerch et al, 1979) through degree 10. Degree 10 was determined by Bowin (1980, 1981, in prep.) to provide a good estimate of geoid anomalies resulting from mass anomalies deep in the earth: those due to the deeper parts of plate convergent zones, from the deep mantle, and those at the core-mantle boundary region. Error

estimates are not available for the GEM-9 spherical harmonic coefficient set. Subtraction of this regional geoid anomaly from the interpolated geoid value at each grid point, yields the residual geoid anomaly which results from mass anomalies in the outer 600 km of the earth (Bowin, 1980, 1981, in preparation). This residual geoid anomaly commonly shows good correlation with surficial geology.

Following gridding, each data set was then contoured using the program GPCP. A latitude and longitude grid overlay was superimposed on the contour plot generated by GPCP. For the gravity and geoid maps, the location of the original measurements used in making the grid interpolations was also plotted with contours and position grid. Additional data outside the map boundaries was utilized in the interpolation of gravity, geoid, and magnetic crustal anomaly values. Thus, the interpolated values near, and at, the edges of the maps are based on data surrounding each point, not only those within the map bounds. The estimated error maps indicate variations in their quality as well as for interior points.

ACKNOWLEDGEMENTS

The development of the rapid and effective storage and retrieval system was aided by the efforts of Skip Little and Robert Groman. This retrieval system has made practical the implementation of the objective mapping interpolation scheme. We thank Brechner Owens for his invaluable guidance in developing these interpolation procedures. Those developments were supported by contracts with the Office of Naval Research and the United States Geological Survey. The preparation of the maps of this Atlas were supported principally as part of the Ocean Margin Drilling Synthesis Program funded by the National Science Foundation and administered by JOI, Inc. This effort has led to further improvements in the interpolation procedures which have been incorporated in preparing the maps of this Atlas.

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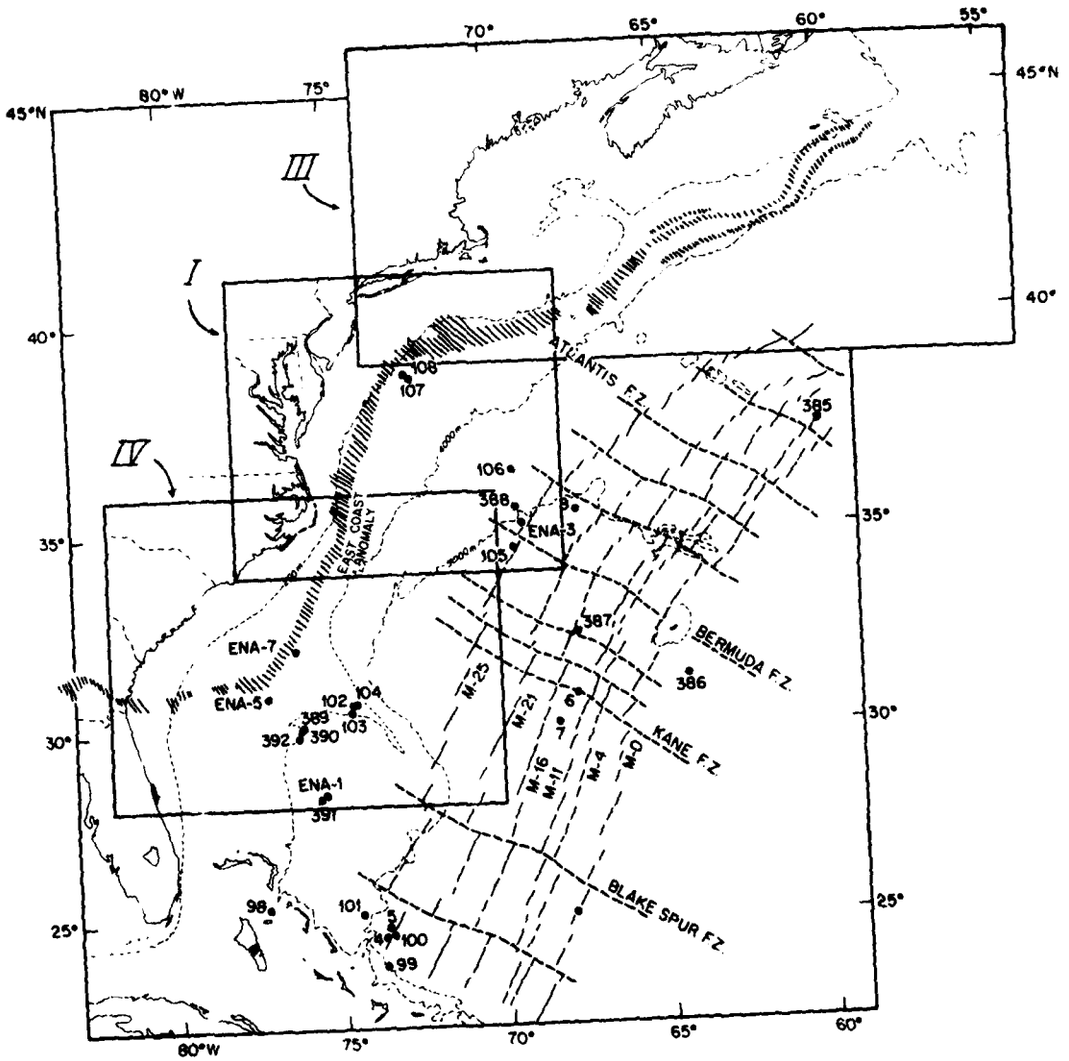
INDEX MAP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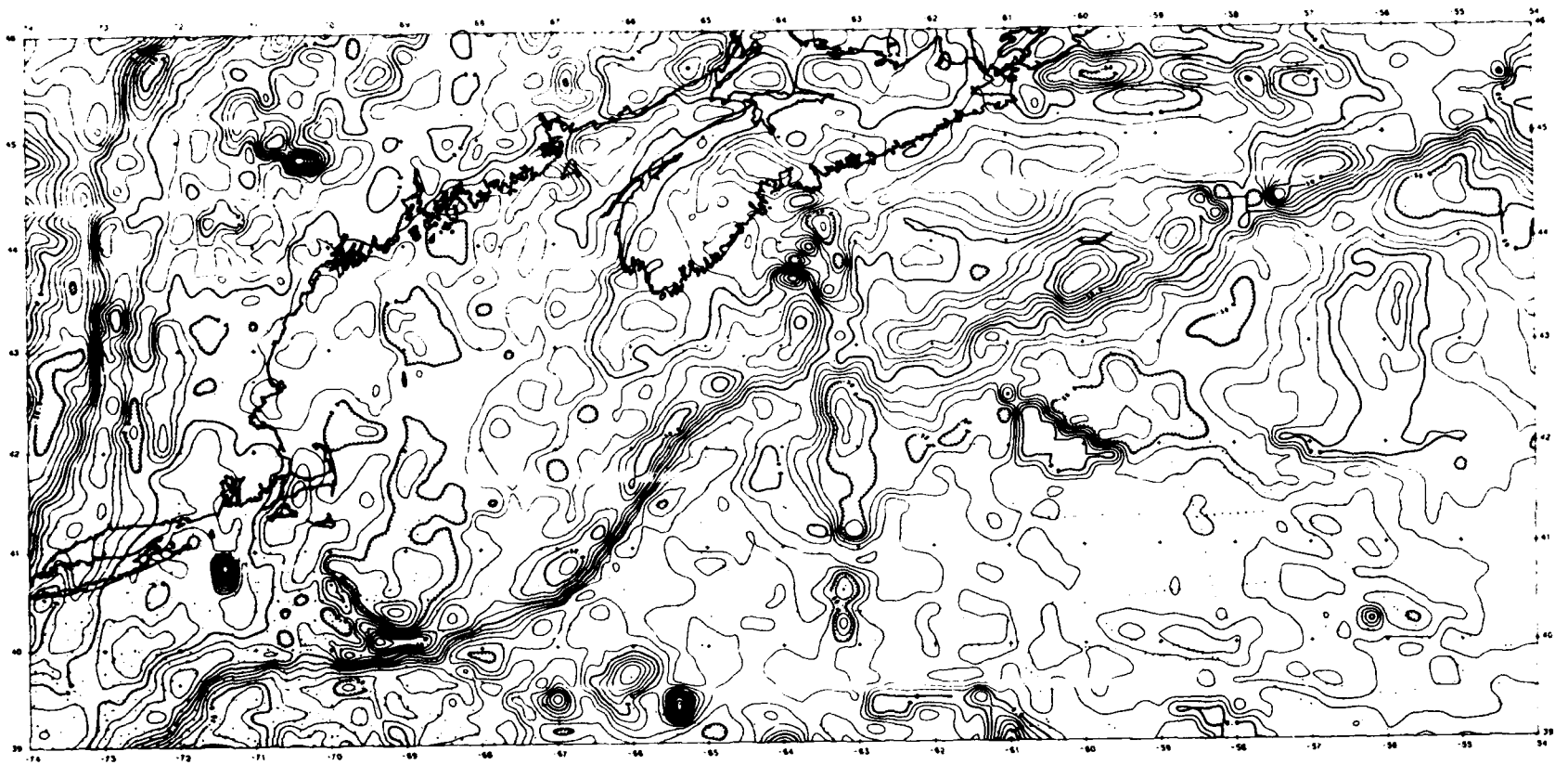

FREE-AIR GRAVITY ANOMALY

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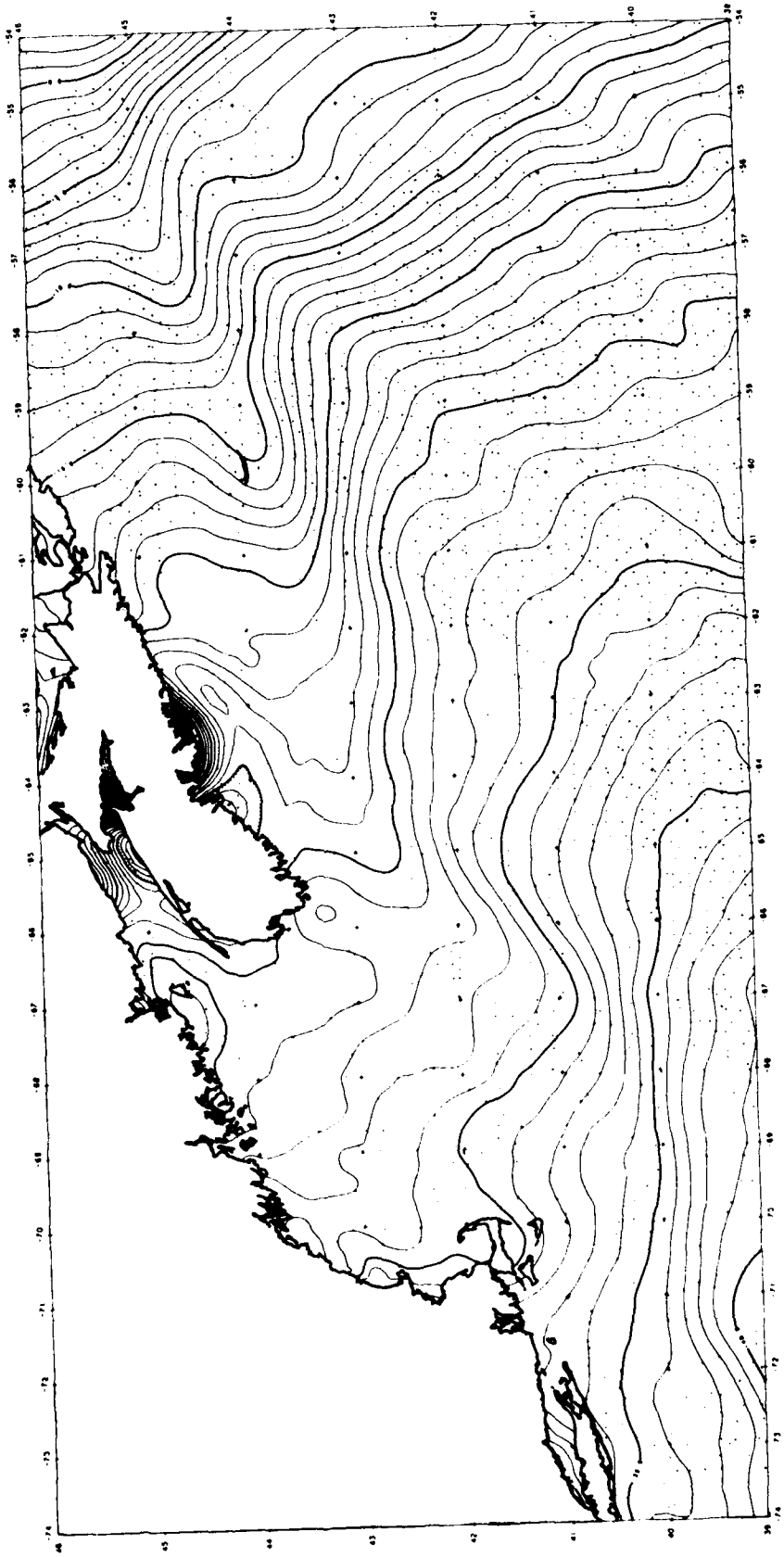

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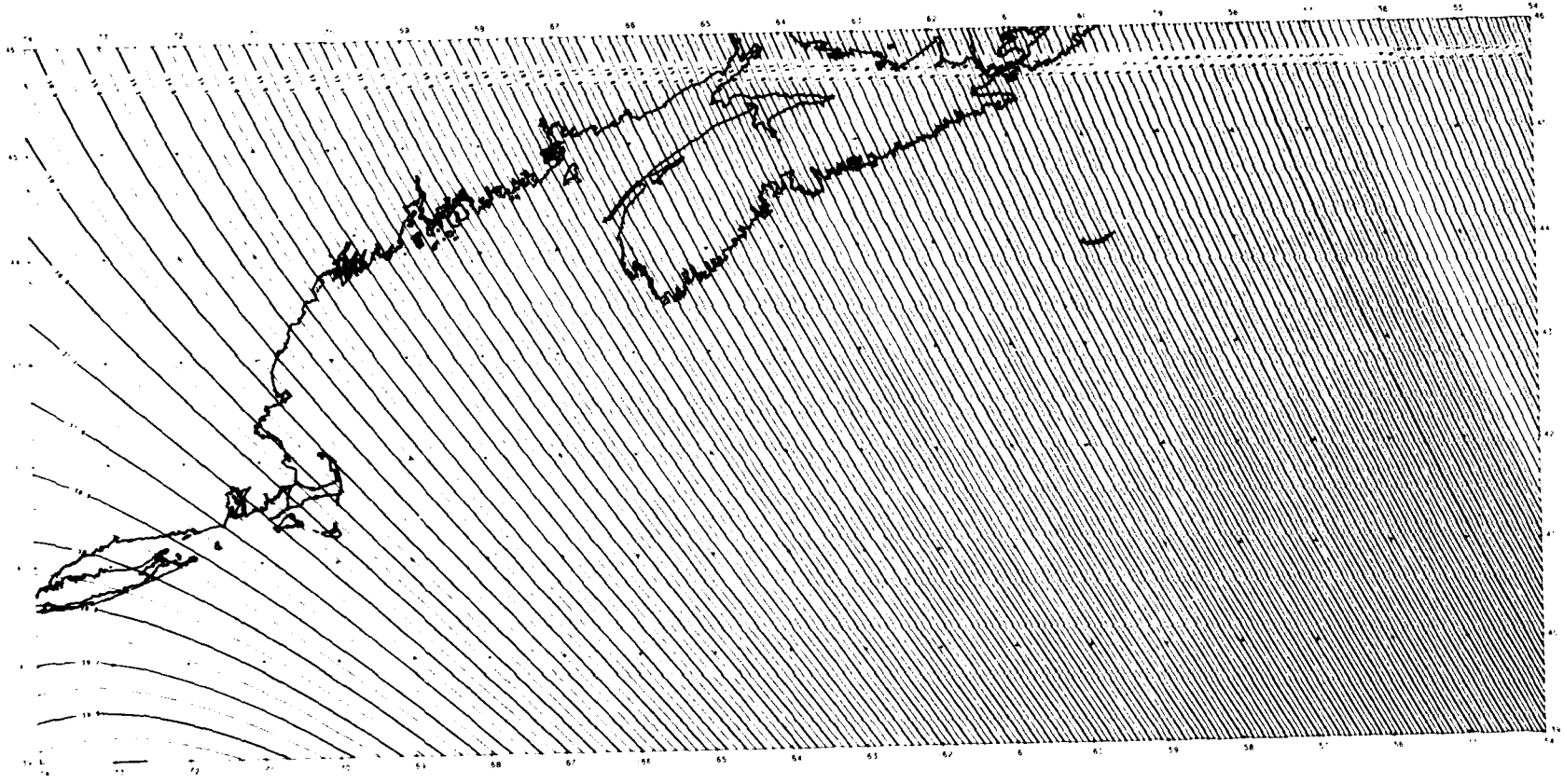

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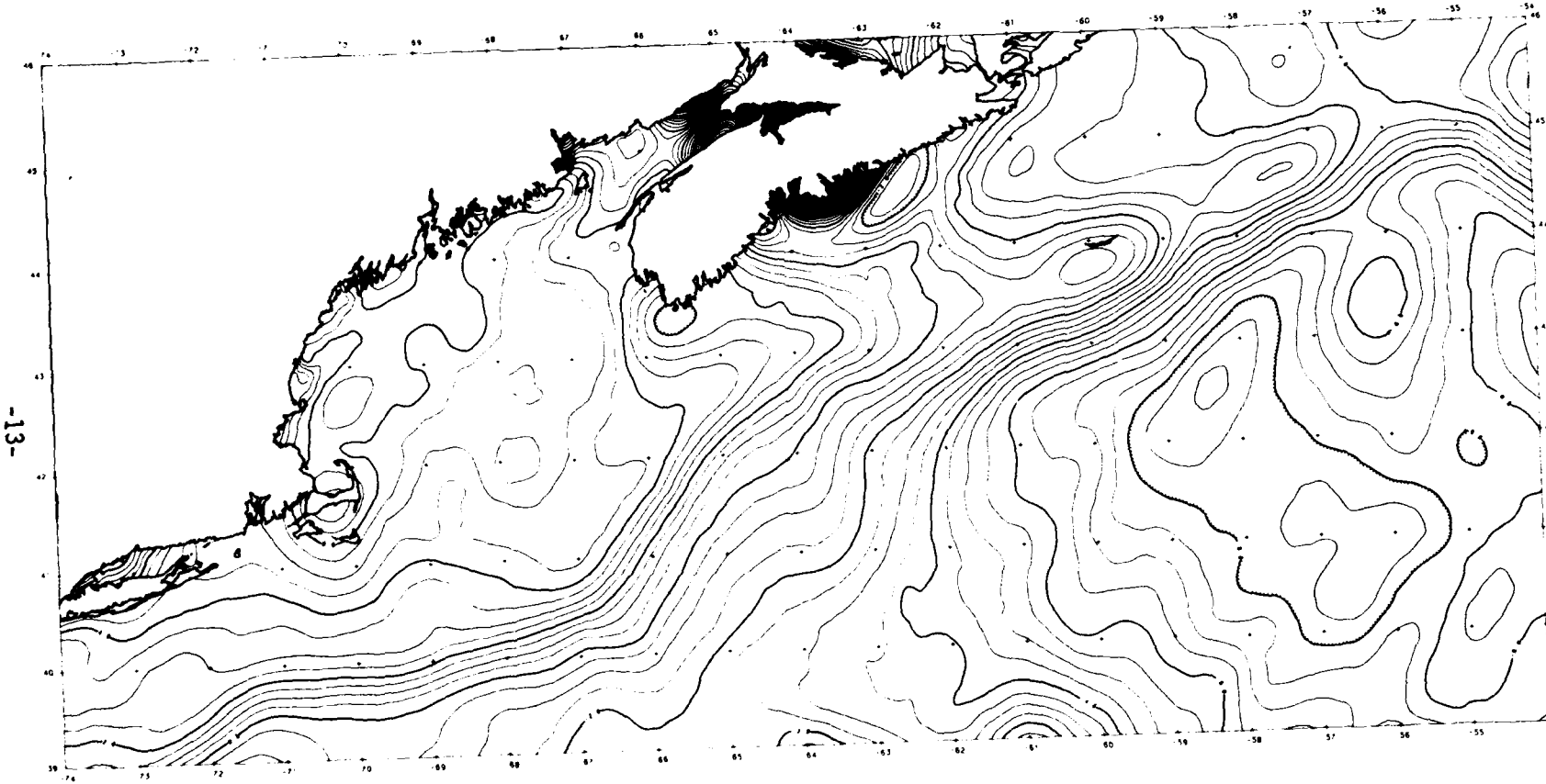

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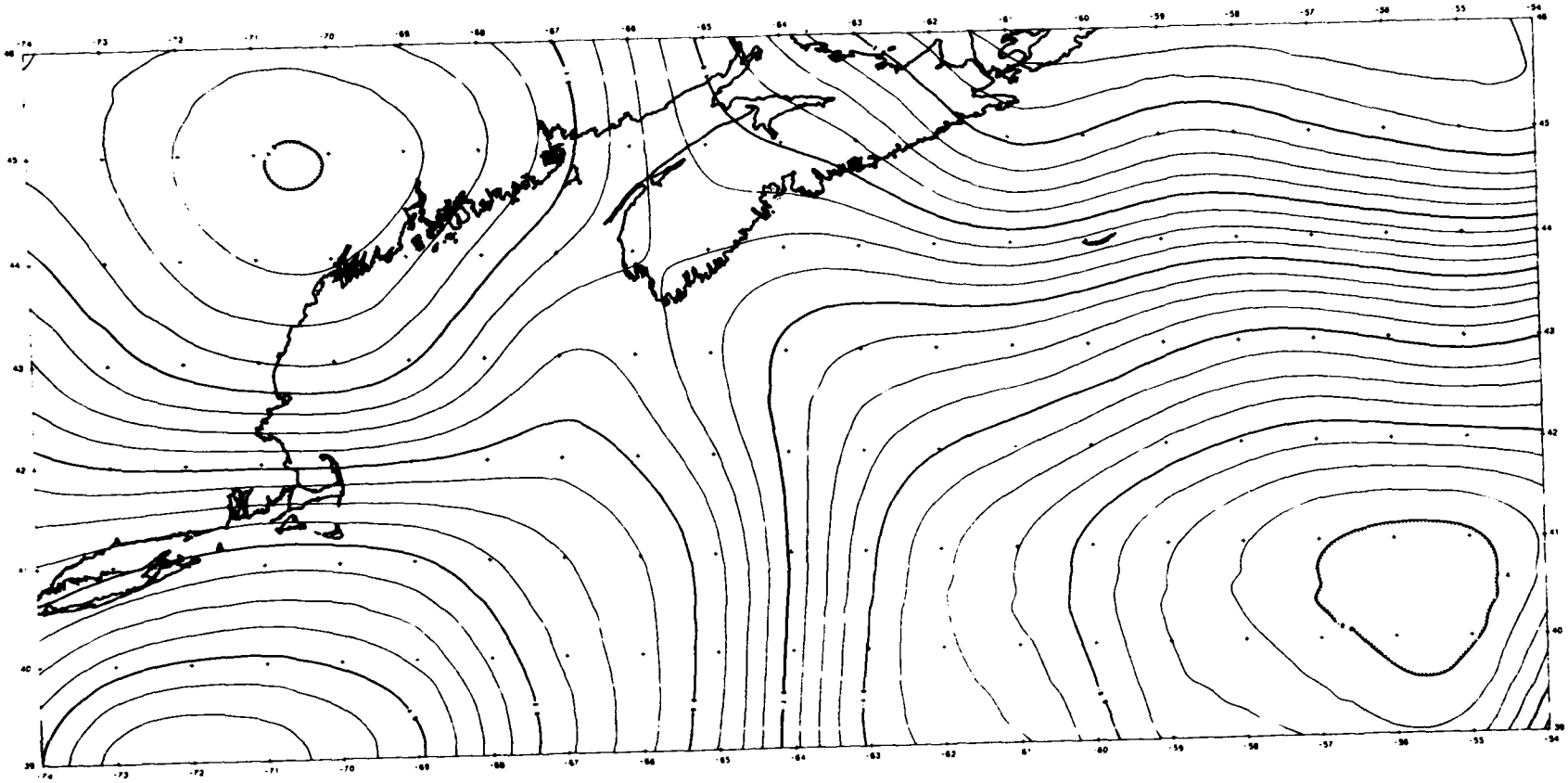

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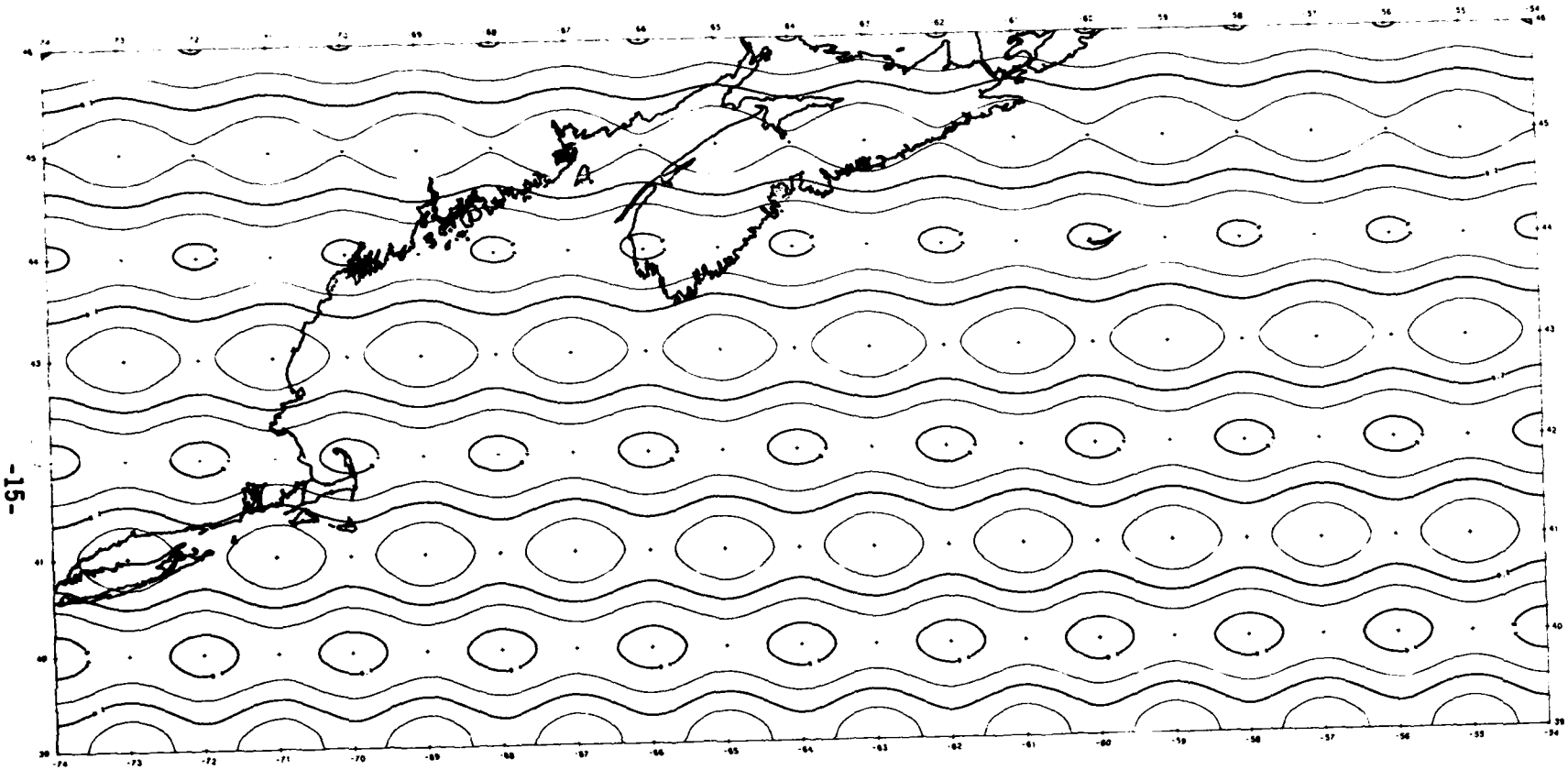

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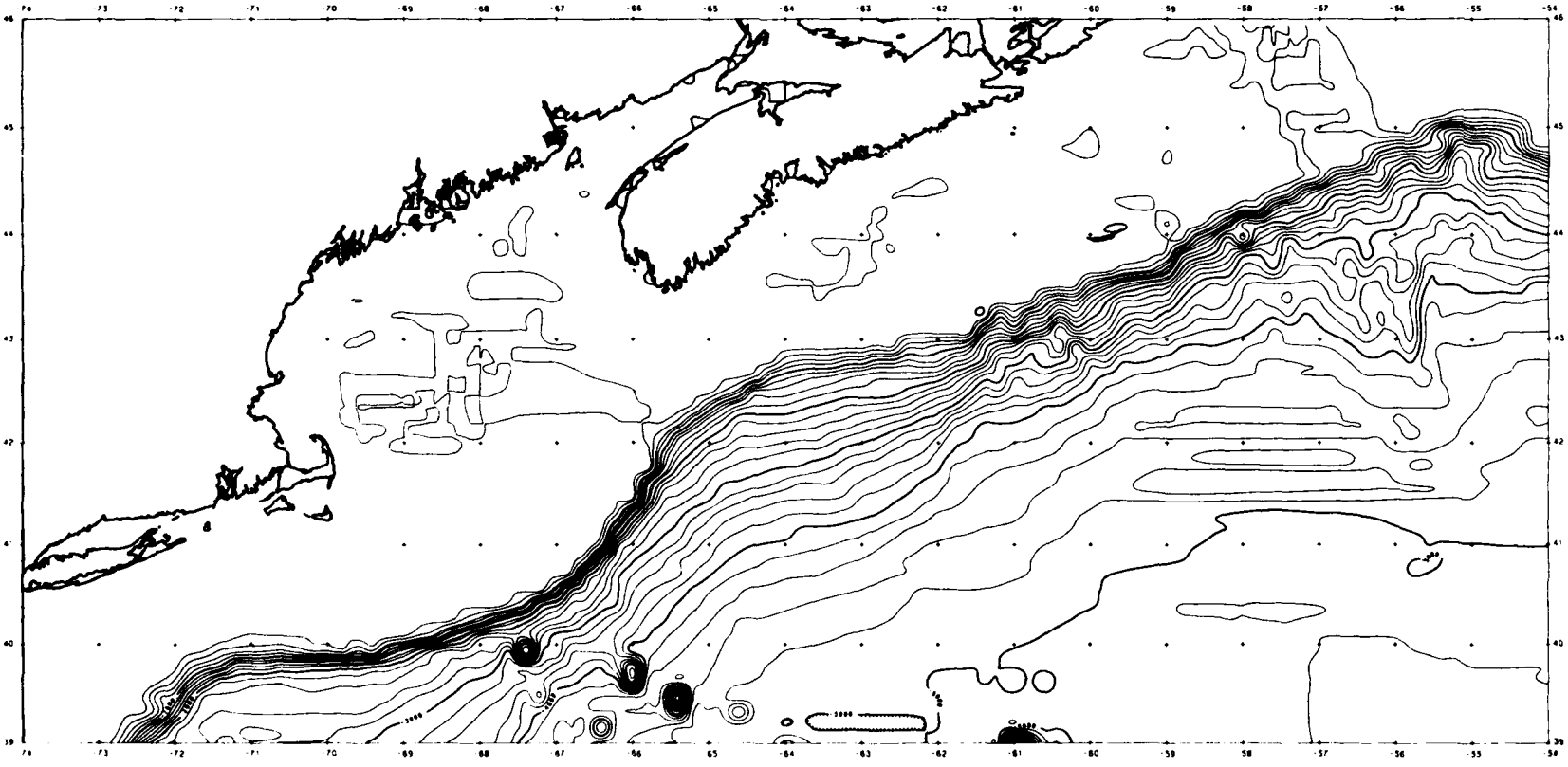

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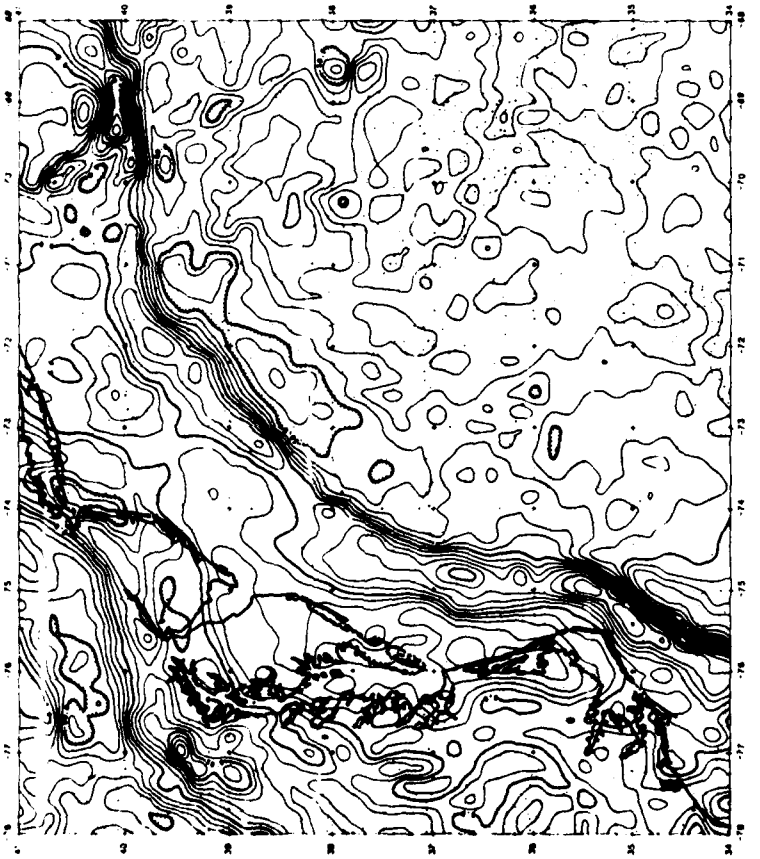

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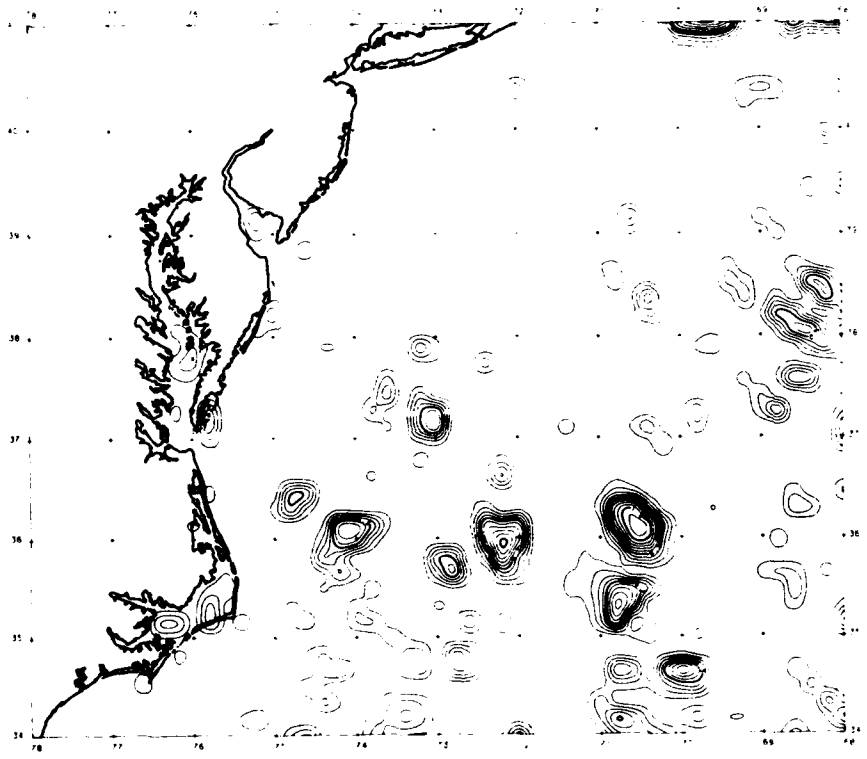

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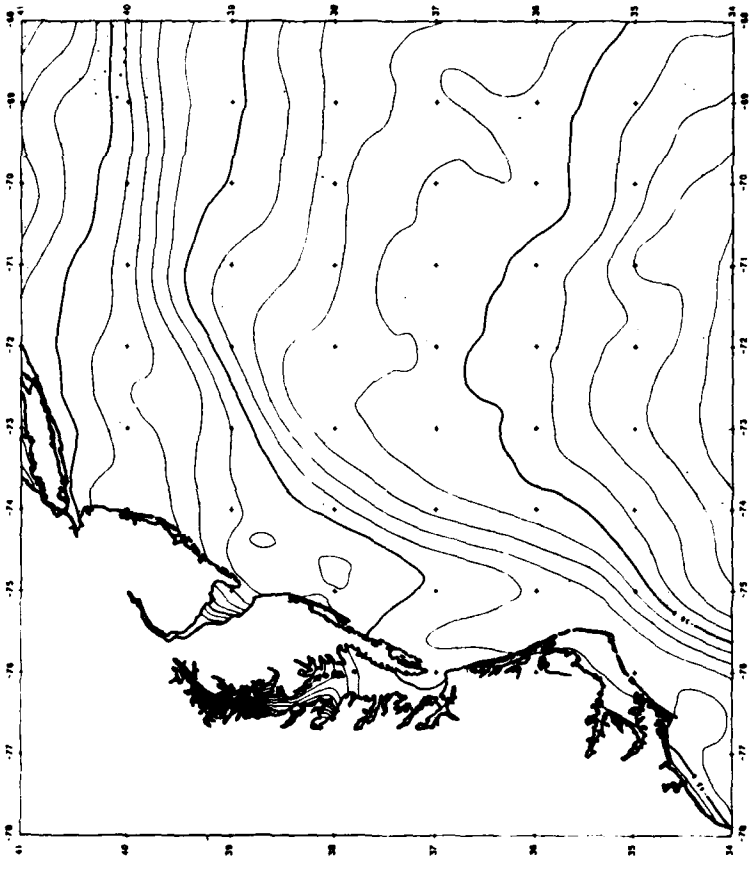

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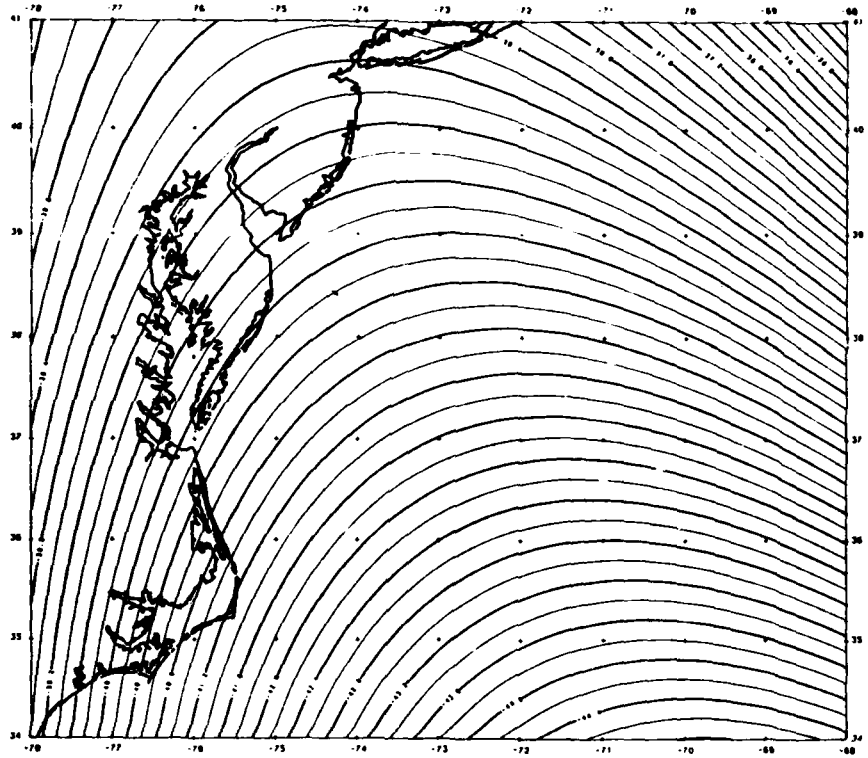

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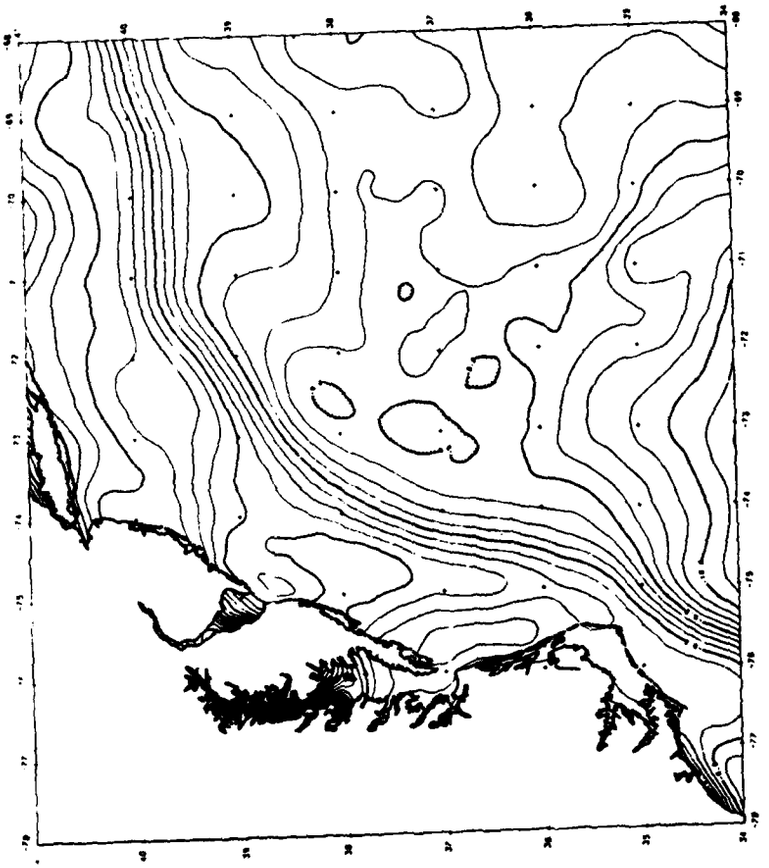

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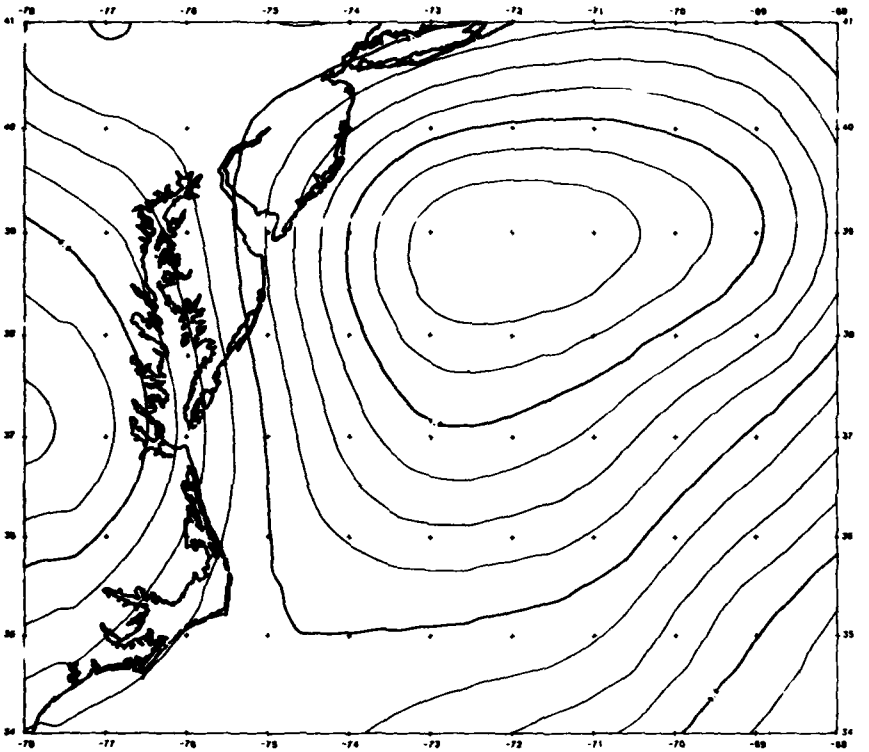

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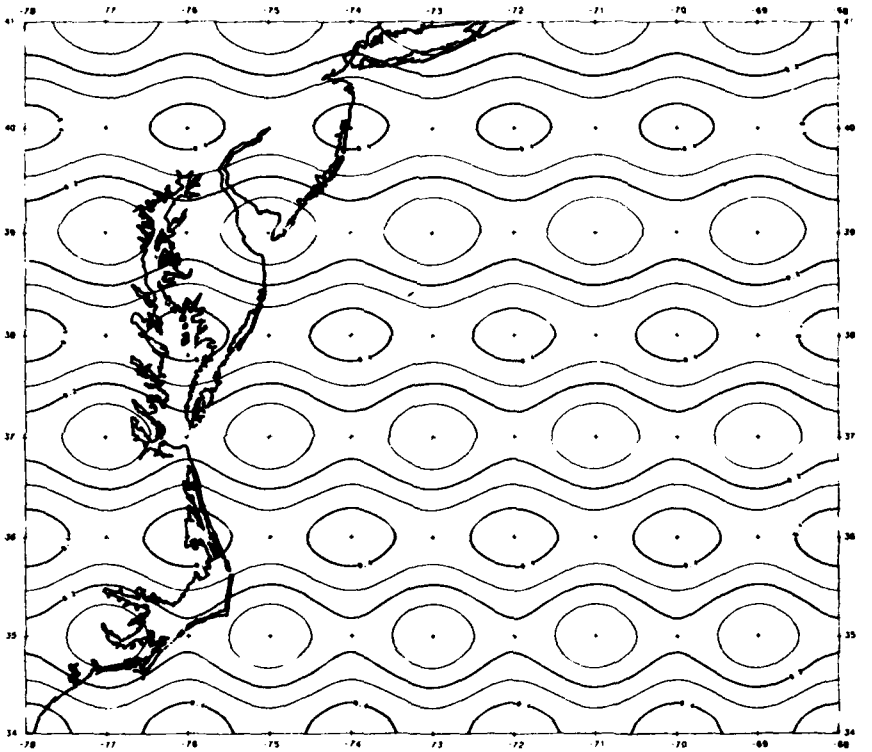

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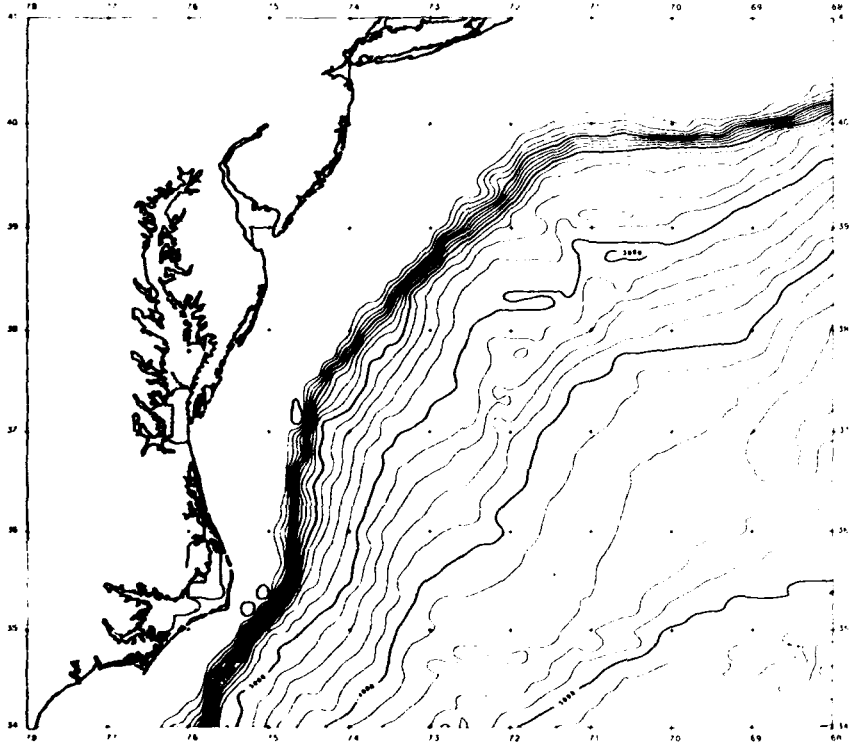

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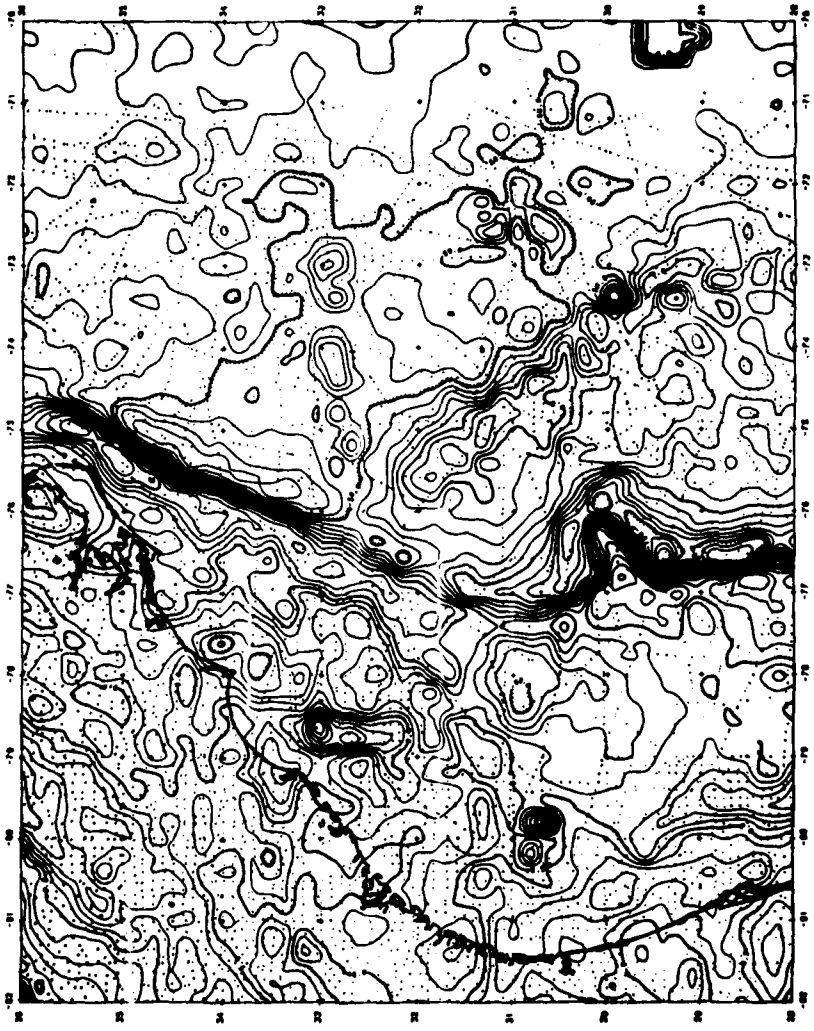

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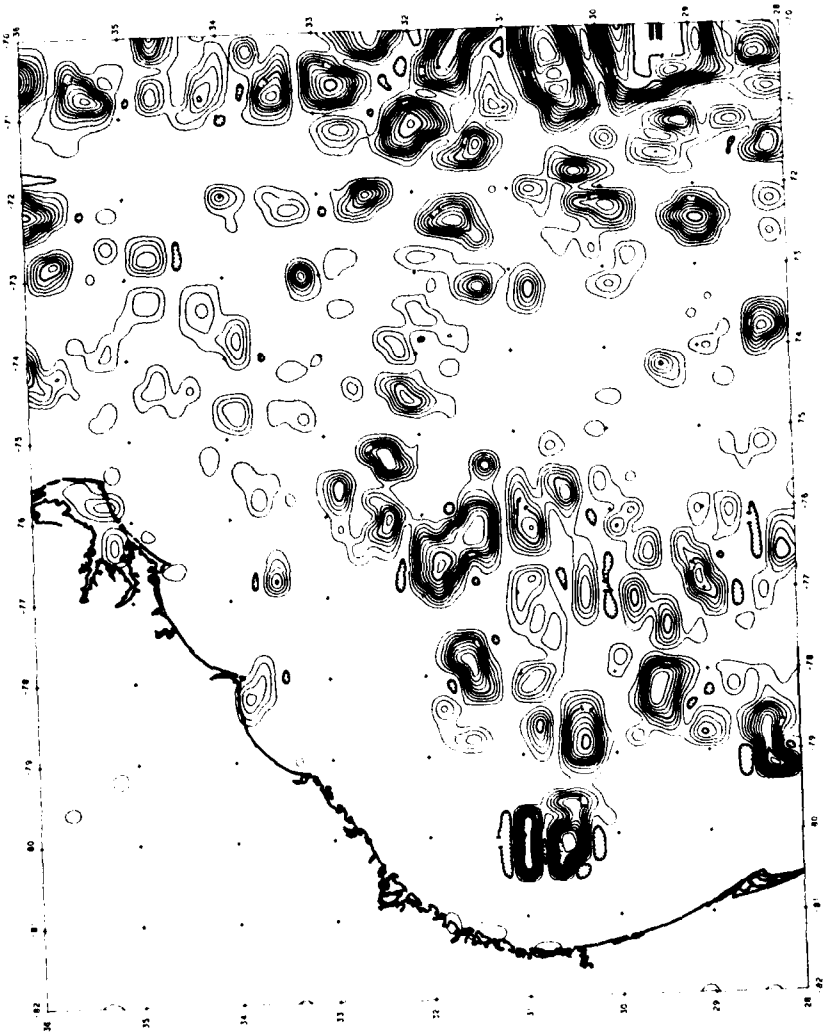

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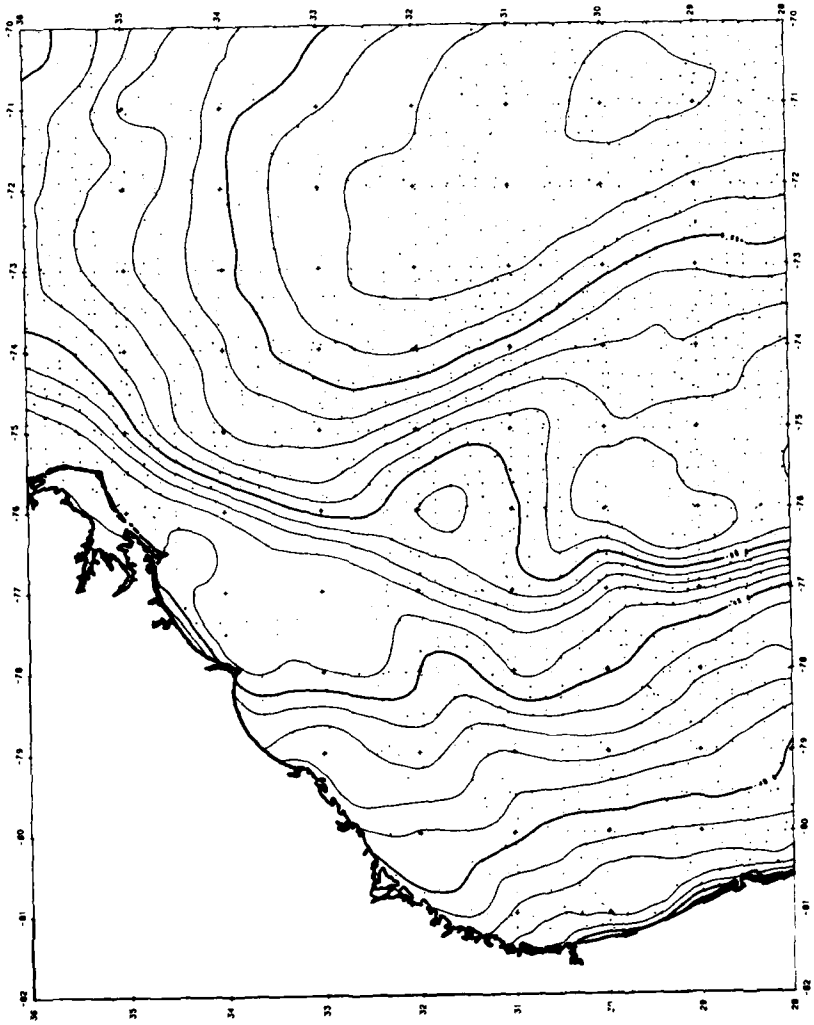

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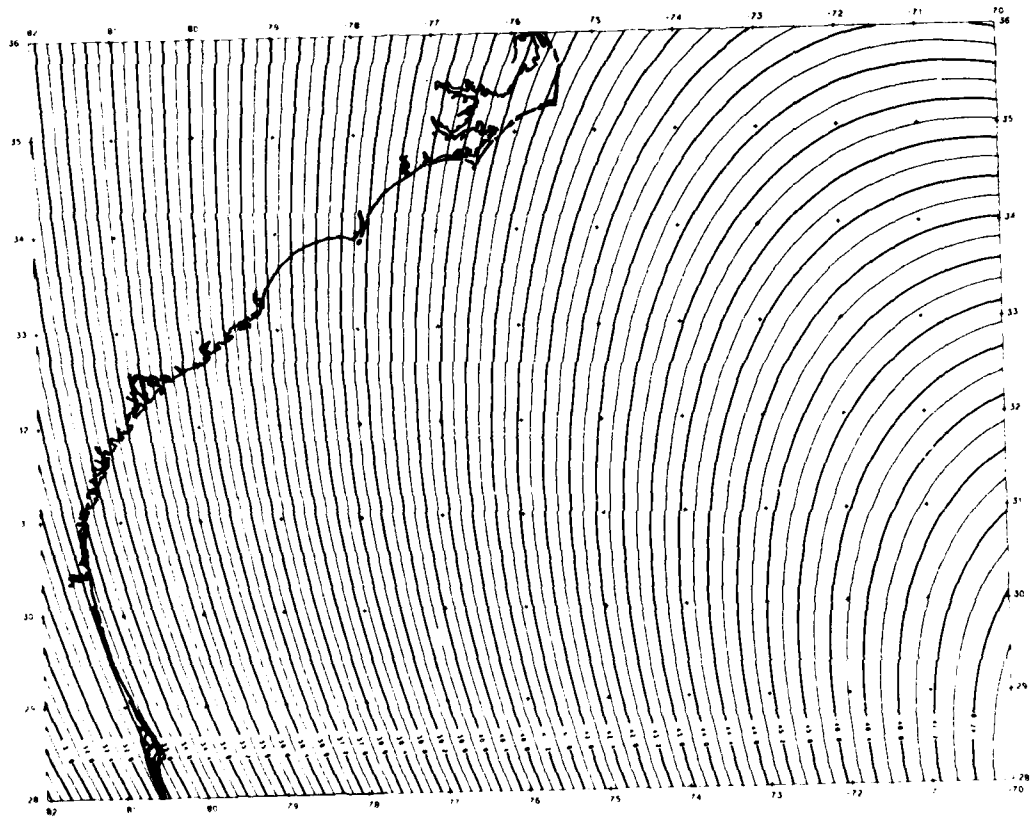

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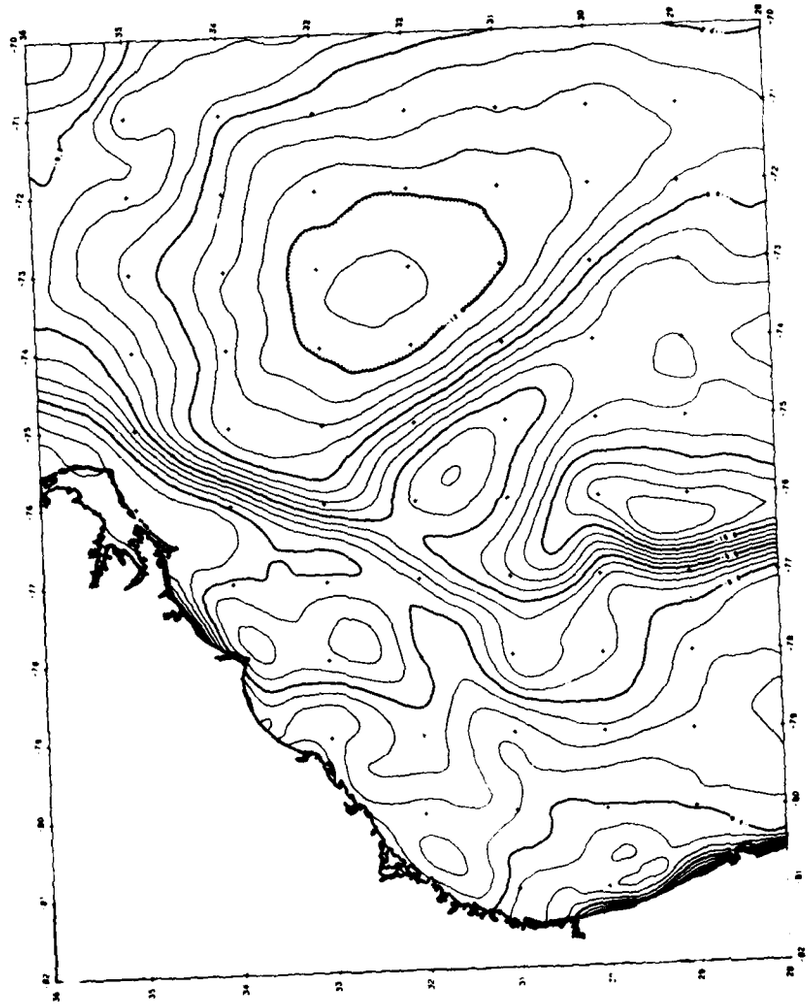

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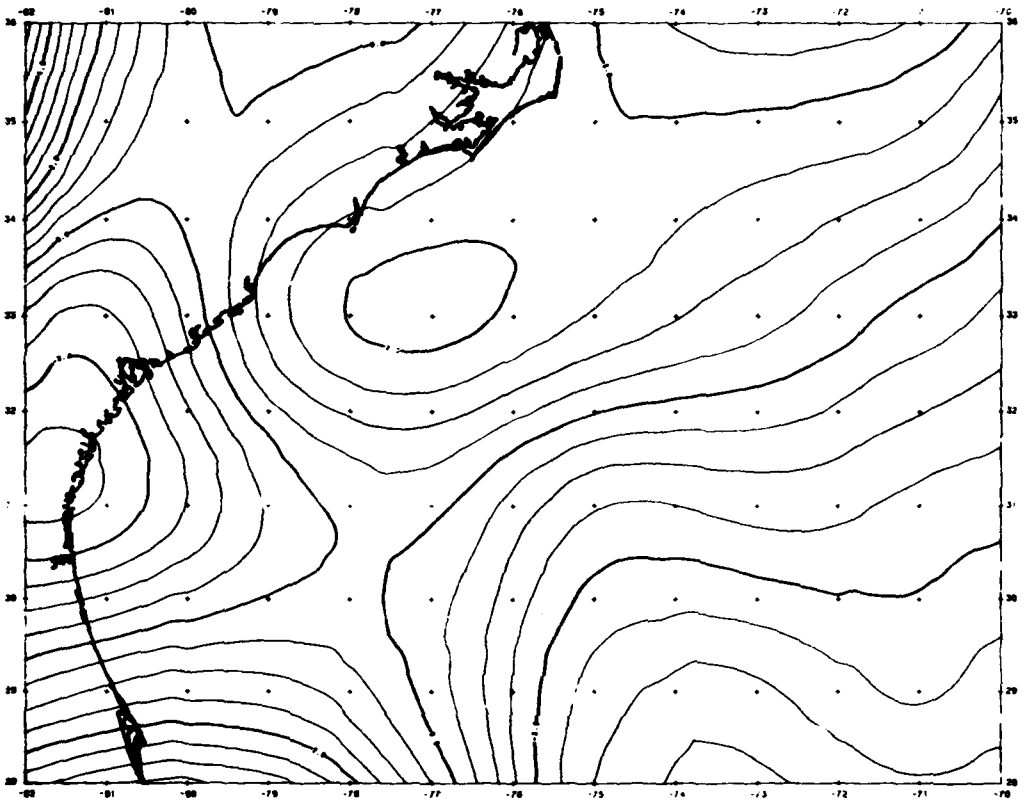

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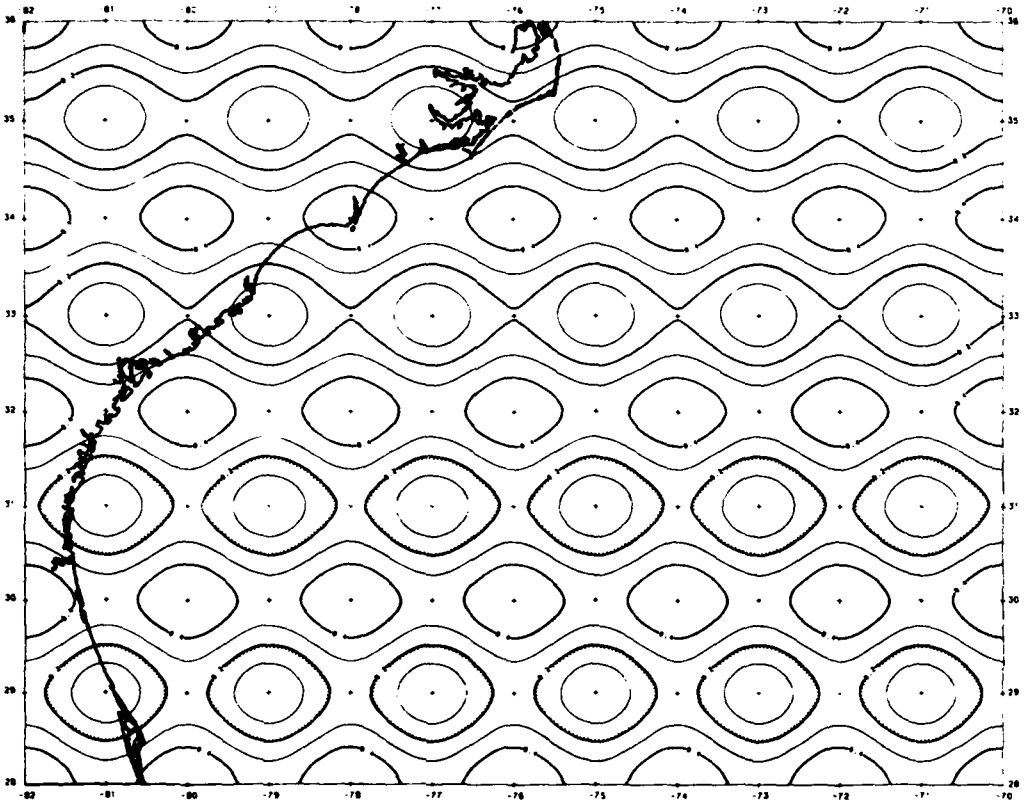

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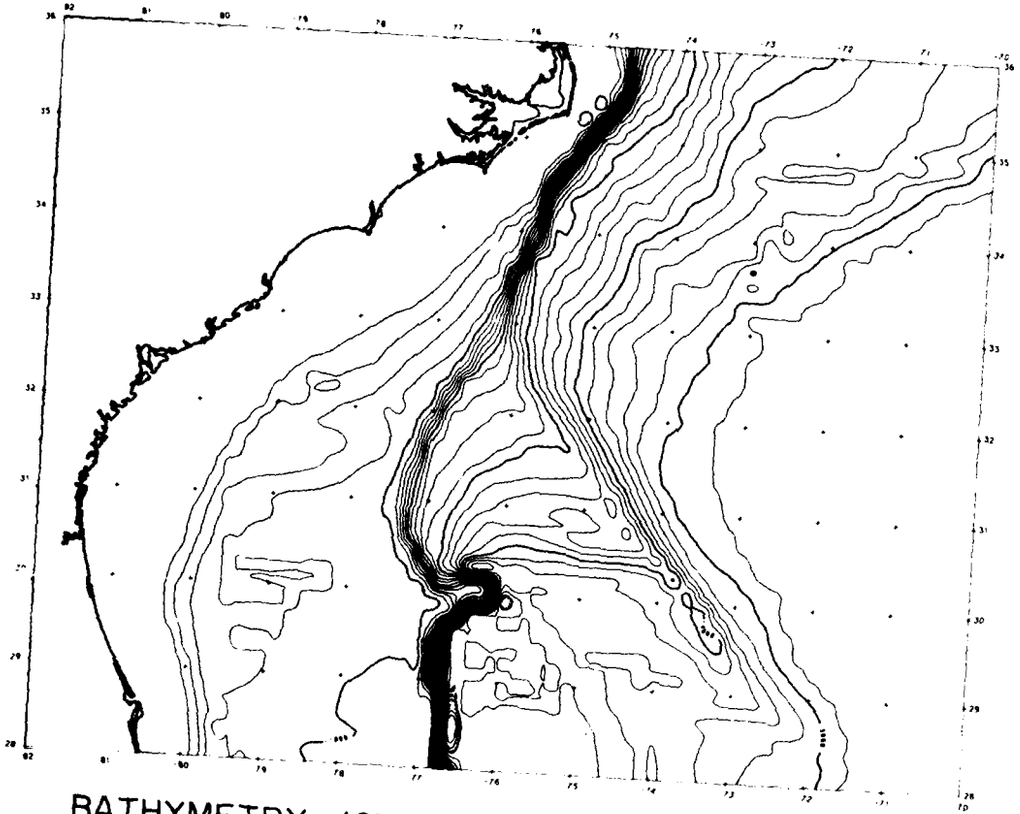

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2. Geographical data processing
3. East coast margin of the United States

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COMPUTER-PROCESSED GEOPHYSICAL ATLAS OF DIGITAL DATA FOR THE EAST COAST MARGIN OF THE UNITED STATES FROM SURFACE AND SPACECRAFT DATA by Carl Bowin, Julie Milligan and Karen Dunkle. 32 pages. December 1981. Prepared for the Office of Naval Research under Contract N00014-82-C-0019 and for Joint Oceanographics Institutions, Inc. under subcontracts 20-81, 24-81 and 21-81.

This atlas comprises maps for the East Coast margin of the United States of free-air gravity anomaly, geoid anomaly, regional geoid anomaly, residual geoid anomaly, magnetic crustal anomaly, and bathymetry. Data from surface measurements, GEOS-III and MAGSAT Satellites, GEM-9 spherical harmonic coefficients, and SYNBAPS Bathymetry profiling system were utilized. Estimated error maps for the geoid data are not included because for the marine areas, these data are uniformly of very low error. The data are presented in three sets of maps of northern, central, and southern portions of the margin.

1. Digital data display; geophysical data
2. Geographical data processing
3. East coast margin of the United States

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IV. N00014-82-C-0019

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